

# AAAS *Bulletin*

American Association for the Advancement of Science

September 1968

**Walter Orr Roberts**

**President, AAAS, 1968**

President, University Corporation for Atmospheric Research  
Boulder, Colorado



## Letter from the President

I have pondered a long time about how to use the unique opportunity of writing the AAAS members my "letter from the President." As I think about the year of my tenure, I realize sorrowfully that, among other things, it is a time when old friends within and without the Association must all too often endure deep rifts of opinion over a wide range of science-involved topics, such as what to do about the UFO reports or the use of herbicides in Vietnam.

Science and technology, meanwhile, entwine themselves ever more rapidly and ever deeper into the fabric of society. They affect the lives of us all in ways that increasingly dominate our choices.

Our day in history desperately needs the optimism traditional of science. Instead of optimism, our nation, blessed with unprecedented wealth, suffers anguishing doubt about whether we have wisely used our wealth at home and abroad. How very urgently we do again need the bold confidence of the Enlightenment of David Hume and his contemporaries, who believed that we are a world of men fully able to govern ourselves, through reason, with freedom, within the security of law, and with social justice.

Let me, however, speak for a moment more personally. My year of closest dependence on Dael Wolfle and his colleagues at our headquarters in Washington has been gratifying. I have gained insight into the depth of commitment of the AAAS staff to the ideals of the Association stated in our consti-

tution: "to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress." I could easily, and with conviction, fill the pages of my letter with documentation of the devotion, the integrity, and the industry of those who serve us on the staff, the Board, and the committees. But I will not do that.

Rather, I want to try to say something of the responsibility of the scientist in the context of the time and the temper of the land. Yet I feel inadequate to the wish; I have that same sense of inarticulateness that struck me on June 7th, when I faced, as a commencement speaker, the graduates of the University of Colorado in the fresh hours after the assassination of yet another brother, whose murder symbolized the frustrations of an age of science that is at once sophisticated and yet barbarian.

At the turn of the century it seemed that the happy wedding of science and engineering would open a wondrously satisfying era, one of fulfillment of the dreams of mankind for material comfort and for security of mind in a world that was increasingly revealed in its order and its beauty. That optimism has faded. The world looks complex. Its resources appear ever more clearly inadequate to stay the hunger and the Earth-despoliation of an exploding population of ill-unified beings lacking in humane will and of conflicting purposes and ideologies. Even our centers of learning are in turmoil, no longer secure

cloisters. Science and technology are deep in the flux of controversy. With the automobile and the superhighway, we have smog. With cigarettes at every store, cancer. With nuclear power, the bomb. With the miracle of TV, its programming. We plan to walk on the moon, and with exquisite concern for the lives of the two or four astronauts who will walk there, we spend hundreds of millions of dollars to assure their safe return. But we find it impossible to marshal the human ingenuity to give food or shelter to the uncounted millions of souls who will die of sheer starvation or exposure.

This is not the world as it ought to be! This is not the world as we of science and of engineering wish the fruits of our labor to make it. It is not the best kind of world that the knowledge of today brings within our grasp. To be sure, we who are scientists and engineers comfort ourselves with the thought that the responsibility for failing our goal is not ours alone, that the uses of science are the social purposes of whole nations of people. And, of course, this is true.

But has not the increasing complexity of social interaction, and the dizzying explosion of material power resulting from technological innovation, made the responsibility of the scientist and engineer greater? Because of our understanding of where the products of scientific advance are taking us, and at what rate, have we not a special duty "to improve the effectiveness of science in the promotion of human welfare"? Do we not have special opportunity to help the public to an enlightened realization of "the promise of the methods of sci-



ence in human progress"? I believe we do have a chance for meaningful commitment to such goals—if not explicitly as engineers and scientists, then as members of the American Association for the Advancement of Science.

How nice it would be, of course, if "little green men" from UFO's would land here and tell us how we should do this. How wonderful if the mysterious coded signals of the pulsars of deep space would be deciphered by the astronomers as the transmitted wisdom of distant civilizations that had been through all this, and could tell us how to achieve the full benefits from an advanced technological circumstance. But it won't happen, I fear. More likely the job will be ours alone.

Never before has the opportunity been so great. We have the knowledge and the means to achieve a living environment of unprecedented quality. And we can do this not only for one nation but for all who travel with us on this planet.

I have no illusions that it will be easy to achieve what we want from our civilization and our moment in history. It will clearly be a long and hazardous job, for scientist and citizen alike, to reach our goal for the human condition. But, as Thornton Wilder said, "every good and excellent thing stands moment by moment at the razor edge of danger, and must be fought for." Can we not wage the right kind of fight for the goal of a Century 20 Enlightenment?

WALTER ORR ROBERTS

### SCIENCE News Department Internships

Newspaper internships are in vogue these days, and it is not surprising that *Science*, along with an increasingly large number of daily newspapers, decided to try the experiment. I had the privilege of being one of the guinea pigs.

Internships for reporters usually follow a simple rule: the larger the employer, the better the pay and the more insignificant the job. Large metropolitan dailies, along with big magazines, believe in paying well, but, more often than not, they are also overstaffed (at least in the places where the intern is likely to work). Interns in such surroundings usually begin ambitiously and finish as classic cases of frustration; they are shuttled from one puny job to another (for large papers believe firmly that newcomers should "learn the ropes," just as everyone else has done), and if they try to go beyond the limits

of their well-defined assignments, they are either officially discouraged or, worse still, end up offending some permanent member of the staff. Reporters' summer vacations, one of the official reasons for the interns' existence, only partially relieve the tension. In contrast, a smaller newspaper usually gives an intern a chance to "show his stuff"—if he has any to show—but at considerably less remuneration.

*Science* offers the best of both worlds. In my case, the pay was above what I had expected. Much more important, however, the News and Comment staff is small (there were five full-time reporters when I came); the fixed rules are few and there is ample opportunity to do something.

Like an intern in any organization, I was essentially an unknown quantity. Fortunately it turned out—after editing, and frequent lectures from Dan Greenberg about the high ratio of clichés per 100 words in my copy—that some of my stories were publishable. And getting his work into print is the intern's most gratifying reward. During my six months with *Science*, I covered a variety of stories, including the new Selective Service Act, the controversy over the Strickman filter, the SST, and the founding of a new medical school.

One of the nice things about working for News and Comment was the informality. The staff came and went as it pleased, with each reporter working at his own pace and in his own style. The easy-going atmosphere may help account for the quality of the product. Good morale does not necessarily make good journalism, but it helps. Not that every story was flawless. Two problems come to mind.

Our gravest fault, I think, is that we all tend to be deadline writers. In some cases, this is necessary, but most of the time it simply creates anxiety and detracts from quality. Editing in the news department is above average, and some things (my clichés, for example) simply do not get by. But deadline writing makes serious editing—tightening up a story's organization—either by the writer himself or by someone else more difficult. Of course, changes can conceivably be made on galley proofs, but that recourse is inconvenient and costly.

Second, we have too much of a Washington and eastern seaboard bias. This problem is certainly recognized, and its seriousness has been greatly diminished by means of frequent out-of-town trips and a *Science* reporter in Europe. But there are limits to what can be accomplished on trips, and one

wonders whether *Science* shouldn't consider sending someone out to the West Coast to set up shop permanently.

Eighteen months ago I had a vested interest in saying that *Science* should have an intern program. Actually, if one of those infamous cost-benefit analyses were to be made, the program would clearly be abandoned as a waste of time, office space, and money. That it will provide future staff members cannot be doubted, but *Science's* reputation is such that it need not adopt this sort of strategy to recruit new reporters.

Fortunately, as I understand it, *Science* did not decide to start the program out of pure self-interest. There was a more ambiguous notion that it was a "good thing" and that, in its own small way, it fitted in with AAAS's role as an educational institution. The reasons for continuing, I think, go further. *Science's* internship is probably among the best, because it offers both freedom and the opportunity to write. This is a small but important contribution towards the future of journalism, for many internship programs probably do more to discourage than to encourage potential journalists. More substantial from the AAAS's point of view, the continual flow of young reporters through *Science* means that, if they learn anything during their few months' stay, they should be able to help improve the public's understanding of science wherever they work afterwards, and most of them will probably remain in the important fields of journalism or publishing.

ROBERT SAMUELSON

### Holiday Science Lectures

Eleven distinguished American scientists were featured as AAAS Holiday Science Lecturers during the 1967-68 academic year. This program, administered each year by AAAS with funds provided by the National Science Foundation, was established in 1961 on a nationwide basis to broaden the scientific horizons of carefully selected groups of high school students and teachers and to communicate to them some of the excitement and inspiration of the scientific endeavor.

The Holiday Science Lectures program has two basic emphases—quality and depth. Both quality and depth are assured by having outstanding scientists present carefully prepared lectures and demonstrations on a single scientific topic. A lecture series is made up of four lectures, each about one hour in



length. Following each lecture there is a discussion period of an hour or so during which the students and the lecturer engage in free discourse about the lecture topic. Audiences range in size from 300 to 500, and attendance is by invitation only. Lectures are held during school holidays—Thanksgiving, Christmas, and Easter—or at the end of the school year.

At each lecture site the lecture series is managed by a local cosponsoring organization, usually a college or university, but often an academy of science, a museum, or a scientific or technical association. AAAS is responsible for overall management of all lectures.

Lecturers, topics, sites, and cosponsors for the 1967-68 Holiday Science Lectures program are listed below:

Willard Bascom, Ocean Science and Engineering, Inc., "Exploring the Ocean" (Detroit, cosponsored by the Engineering Society of Detroit).

James F. Crow, University of Wisconsin, "Genetics and Man's Future" (Philadelphia, cosponsored by the Franklin Institute).

Edward E. David, Jr., Bell Telephone Laboratories, "Communication: Men and Machines" (Honolulu, cosponsored by the Hawaiian Academy of Science and the Hawaiian Science Teachers Association).

William A. Fowler, California Institute of Technology, "The Origin of the Elements" (Atlanta, cosponsored by Emory University).

Robert Jastrow, Institute for Space Studies, "Cosmic Evolution" (Dallas, cosponsored by the Dallas-Ft. Worth Council of Scientific Societies).

Mark Kac, Rockefeller University, "Chance and Regularity" (Albuquerque, cosponsored by the University of New Mexico and the American Society for Quality Control, Albuquerque Section).

Frank Press, Massachusetts Institute of Technology, "The Internal Constitution of the Earth" (Chicago, cosponsored by the Field Museum of Natural History).

Theodore T. Puck, University of Colorado, "The Mammalian Cell" (Pasadena, cosponsored by the California Institute of Technology).

Walter Orr Roberts, National Center for Atmospheric Research, "The Atmosphere of Our Planet" (Granville, Ohio, cosponsored by Denison University).

Arthur L. Schawlow, Stanford University, "Lasers and Coherent Light" (Raleigh, cosponsored by the North Carolina State University).

Robert L. Sinsheimer, California Institute of Technology, "Of Life and Time and Molecules" (Phoenix, cosponsored by the Arizona Council of Engineering and Scientific Associations).

Responses from students, teachers, and lecturers indicate that the AAAS Holiday Science Lectures are exceptionally popular. Each year AAAS receives requests to present more lecture series than can be funded.

Lecturers for the 1968-69 academic year Holiday Science Lectures program include James F. Crow, Frank Press, Robert Jastrow, Edward E. David, Jr., Willard Bascom, Mark Kac, Robert L.

Sinsheimer, Seymour Kety, Carroll Williams, George Wald, and Walter Orr Roberts. Cosponsors include the Field Museum of Natural History, Chicago, Dallas-Ft. Worth Council of Scientific Societies, Vanderbilt University, Oklahoma City University and the Frontiers of Science Foundation, Arizona Council of Engineering and Scientific Associations, Reed College, University of Utah, San Jose State College, State University of New York at Buffalo, and the University of Connecticut.

WILLIAM T. KABISCH

Assistant Executive Officer  
AAAS

## Science in Technical Education

The first phase of a study of science in technical education, which is being conducted by a task force of the AAAS Commission on Science Education, culminated in a national conference in Washington, D.C., on July 22-23, 1968. Fifty leaders in technical education from universities, junior and community colleges, federal and state governmental agencies, industry, and professional associations attended.

The plan for the study provides for an examination of the status of science education in vocational and technical education. Vocational education is, for this study, occupational training at the less-than-college level. Technical education consists of formal occupational training at the college level up to and including curricula leading to the baccalaureate degree in technology. Excluded are programs for the training of engineers, physicians, and other professional-level persons. The current phase of the study has been limited to technical education related to the physical sciences and engineering, the largest part of which occurs in junior and community colleges. Technical education in fields related to the biological sciences and vocational training will be considered later.

The Commission's interest in vocational and technical education stems from the fact that, while major problems have been recognized in science education at the elementary- and secondary-school levels and in higher education, and vigorous steps have been taken during the past decade to correct them, relatively little attention has been given to those sectors of secondary-school and higher education that are involved primarily in occupational education and training. Much of the change that has

been brought about in the teaching of science during the past decade has been the result of the active interest and participation of the scientific community. The present study is directed to the question of whether scientists and engineers should participate to the same degree in efforts to solve the problems of science education in the broad range of occupational training.

During the four months beginning in February 1968, a staff member of the Commission's Task Force attended national conferences on the subject, visited institutions, and analyzed the literature concerned with the training of technicians for the physical science and engineering related technologies. The result was a report to the Commission on Science Education that there are, indeed, serious problems which would be of concern to the Commission. It was decided that a national conference would be useful to put these prob-

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### AAAS Bulletin

Vol. 13, No. 3

AAAS Misc. Publ. No. 68-10

Published quarterly by the

American Association for the  
Advancement of Science

1515 Massachusetts Avenue, NW  
Washington, D.C. 20005

Second-class postage paid at Washington, D. C. Single copy, 35 cents; annual subscription, \$1.00.

Annual dues in AAAS are \$12.00. Each member receives the *Bulletin* and the scientific newsweekly *Science*.

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lems into perspective and to formulate courses of action appropriate for the guidance of governmental and private agencies in program planning.

### The Problems

The conference was organized around problems and topics that can be grouped in nine categories:

1. *Technical Education in the American Educational System*—the place of an emerging new type of higher education as it is related to other segments of the total educational structure, with associated problems of status, articulation, relevance to its mission, and effectiveness.

2. *Technicians in the Labor Force*—the identification of technical occupations, their classification, the relationship between supply and demand, and the utilization of technicians by their employers, with particular reference to the relationships between the knowledge and skills taught in the technical training programs and the actual requirements of the jobs.

3. *Measurement of Supply and Demand*—the need to develop new and better techniques to determine the supply of technicians and to estimate future demand, especially in view of technological change which is creating cross- and multidisciplinary technical occupations that are increasingly removed from the traditional disciplines of science and engineering.

4. *Institutions*—the basic question of whether or not the nearly 600 institutions (largely junior and community colleges) which offer occupational curricula are adequately organized and coordinated to meet both local and national needs, and whether or not the voluntary and involuntary controls under which they operate are beneficial or deleterious to technical education as a whole.

5. *Students*—the identification of scholastic and other characteristics of students best suited for technical training; reasons for students' selection or rejection of technical training programs; adequacy or relevance of secondary-school science and mathematics instruction as prerequisites to successful completion of technical courses; reasons for attrition; and reaction of technical graduates to both their secondary-school and college science and mathematics courses.

6. *Teachers*—the need for optimal pre-service academic and practical training for successful teaching in technical education programs; the need for supplemental education and training; problems of identification by technical education faculty with their peers in other sectors of higher education; and work loads and other working conditions.

7. *Curricula*—the relevance of the technical training programs, in general, to the needs of both technical students and their future employers; methods for keeping the curricula up to date and for developing new curricula (e.g., environmental pollution, biomedical equipment technology, etc.); articulation of two-year programs with upper-division technical programs to provide better opportunity for technical students in community and junior colleges who decide to continue to the baccalaureate-degree level.

8. *Science and Mathematics Courses*—the unique requirements for content and methodology in technical training programs as compared with traditional academic programs for liberal arts and pre-professional students; methods by which science and mathematics courses for technical training programs are developed; the need for new supplemental science and mathematics teaching materials; and means for keeping science and mathematics courses in technical training programs up to date and articulated with prerequisite secondary-school courses.

9. *Methods*—the need for the development and application of new educational techniques in the training of technical students, including the adaptation and adoption of some types of computer and programmed learning, as well as other approaches to individualized learning, when these will increase the effectiveness of instruction; the use of consortia and cooperative work-study programs, and other approaches appropriate to the mission of the technical education program.

### Results of the Conference

Conference participants deliberated on a number of questions within each of the above categories and produced a list of "courses of action" within each of them. Some of the issues which may be of special interest to readers of the *Bulletin* are discussed below without reference to specific conference recommendations. A detailed report of the conference is being prepared by the Commission's Task Force.

#### *The Status of Technical Education*

The technician work force essentially is a wedge that is occupying an expanding gap in the labor force between the skilled craftsman and the scientist and engineer. The need for the technician has developed because of the increasing tendency of the professional person, both in training and in occupation, to move away from the applied and practical and toward the theoretical. At the same time, applications of technology are becoming increasingly complex and require skills and knowledge not provided in the training of the skilled craftsman. Technical education has emerged to fill this gap. It is generally agreed that technical training programs should be at the college level, and they are being conducted largely by community and junior colleges along patterns and at levels of rigor established by the private technical institutes. This is especially true of the training of technicians for the physical science and engineering related technologies. Most of the 600 of these institutions which offer occupational training have one or more "curricula" in this general category, and new community colleges are

being organized at approximately the rate of one each week.

The task to be accomplished is impressive. According to the Bureau of Labor Statistics, there were about 845,000 technicians employed in the United States in 1963; between 887,000 and 1,290,000 will be needed by 1975. Of the 90,000 technicians who entered the technician work force in 1963, only half had had formal technical training. The Bureau of Labor Statistics estimates that there will be approximately 678,000 new entrants into the technician work force between 1963 and 1974, and that 434,000 of them will be trained in post-secondary preemployment programs, primarily at the two-year, associate-degree level, largely in the community and junior colleges.

Despite the need for technicians, and the large number of institutions offering technical curricula, many technical courses in the junior and community colleges are not filled. Much of this apparent lack of interest in technical careers by capable high school students is attributed to lack of status of the technical training programs. Many students, teachers, counselors, parents, and peers view the technical curricula as not actually being "college" as compared with the departments in the same institutions which prepare students to continue to the upper division of four-year institutions toward completion of liberal arts or professional education. The thought was expressed frequently in the conference that the status of technical education must be enhanced if students are to "choose" it rather than "settle for" it.

One of the reasons for the relative lack of status of technical training programs in the junior colleges is that they present to the technical student virtually a "closed door," should he wish to continue his training at a higher level. There is a growing number of four-year institutions that offer technology programs leading to the baccalaureate degree in technology (e.g., the University of Illinois, Purdue University, the University of Houston, etc.). Some have straight four-year curricula, combining technical and liberal arts subjects; a few have "2 + 2" curricula in which the student who completes the first two years is qualified to go to work as a technician. If he wishes to continue to the bachelor's degree, however, the second two years provide some additional technical training, some additional liberal arts, and some courses in business administration, merchandising, or other subjects which prepare him for

work for which basic technical training is prerequisite.

Because of lack of basic articulation, there is little opportunity today for the graduate of the technical curriculum with the associate degree from a junior or community college to transfer to the upper-division level of four-year programs. The conference stressed the need to bring these two types of institutions closer together, but warned that great care should be taken not to damage the effectiveness of the two-year institutions in carrying out their mission of training technicians for immediate employment. It was generally felt that if a proper articulation of these two types of institutions could be effected, it would do much to raise the status of the two-year technical training programs, and they would then attract larger numbers of capable students.

#### *Science and Mathematics Instruction in Technical Curricula*

Another problem in which the scientific community can become more deeply involved, to the benefit of technical education, centers on the need for and nature of science and mathematics in technical curricula. This especially is true for the complex multidisciplinary technologies. The determination of the necessary scope and level of content of science and mathematics provides a continuing problem for those who develop technical curricula and the science and mathematics courses within them. More assistance from scientists, mathematicians, and engineers is needed to solve this difficult problem, but how it is to be secured still is not clear. However, it is obvious that the science in these curricula is science, and that only scientists, working with engineers, educators, and employers, can prescribe its content.

#### *Teacher Education*

The education and training of science and mathematics faculty for technical training programs received major attention at the conference. It was generally agreed that traditional, research-oriented, academic training in science or mathematics does not, in itself, provide the ideal preparation for teaching technical students. Both students and subject matter in technical training programs are inclined toward the applied rather than the theoretical. Pedagogical techniques and course content which may successfully prepare the "academic" student for advanced study often do not meet the needs and interests of technical students. The conferees agreed, also, that the teacher of science or



mathematics in technical training programs should have at least some "exposure" to the industrial environment in which the graduates eventually will be employed. The problem is complicated by the fact that many science and mathematics teachers in junior and community colleges teach both technical and transfer students.

#### Conclusion

The conference made it clear that technical education has emerged as a major sector of the higher educational system, but almost unnoticed except by those who have been directly involved; that there are many problems that cannot be solved by technical educators alone, but must have the cooperation of others; and that, by active participation, the scientific community can make an important and valuable contribution to the quality of this new venture in higher education.

#### Task Force

The Task Force of the Commission directing the study consists of: Burton H. Colvin, Head, Mathematics Research Laboratory, Boeing Scientific Research Laboratories, Seattle, Washington (Chairman); William T. Kabisch, Assistant Executive Officer, American Association for the Advancement of Science, Washington, D.C.; William C. Kelly, Director, Office of Scientific Personnel, National Research Council, Washington, D.C.; Vincent J. Schaefer, Director, Atmospheric Sciences Research Center, State University of New York, Albany.

HOWARD F. FONCANNON

Staff Secretary

Task Force on Technical Education  
AAAS

#### 1969 Arid Lands Conference

Over forty invited and one hundred contributed papers are scheduled to be presented at the *International Conference on Arid Lands in a Changing World*, to be held on the University of Arizona Campus, 3-13 June 1969. This conference, sponsored by the AAAS with the support of Unesco, is being arranged by the AAAS Committee on Arid Lands with the assistance of an international Program Committee.

The Preliminary Program, to be available by 1 October 1968, will be sent on request.

ARID LANDS CONFERENCE

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# Objects and Rules of the American Association for the Advancement of Science,

Adopted at Philadelphia Sept. 20. 1848.

## 1. Objects

The Society shall be called the AMERICAN ASSOCIATION for the ADVANCEMENT of SCIENCE. The objects of the Association are, by periodical & migratory meetings, to promote intercourse between those who are cultivating science in different parts of the United States, to give a stronger and more general impulse, and a more systematized direction to scientific research in our country, & to procure for the labours of scientific men, increased facilities & a wider usefulness.

### American Association for the Advancement of Science

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Washington, D.C., 20005

Second-class postage paid at Washington, D.C.

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POUGHKEEPSIE NY 12603